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A REVIEW OF THE GENUS *CHLORONIA* IN COSTA RICA, WITH THE DESCRIPTION OF TWO NEW SPECIES (NEUROPTERIDA: MEGALOPTERA: CORYDALIDAE)

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Abstract.—The genus *Chloronia,* containing 10 previously described species, is limited to the Neotropical Region. Recent large collections from Costa Rica reveal the presence of 5 species in the country. *Chloronia mexicana* and *C. gloriosoi* are recorded for the first time from Costa Rica, and *C. absona* and *C. osae* are herein described. *Chloronia mirifica* is the most frequently encountered species and the only one previously recorded from Costa Rica.

The genus *Chloronia* is found only in the Neotropical Region, where, because of its color (yellow marked with black spots), it is one of the most easily recognized genera of the family. Penny & Flint (1982) revised the genus, recognizing ten species and providing a superficial description of the larva for the first time. At that time only one species, *C. mirifica* Navás, 1925, was known from Costa Rica. During the eighties, with extensive collecting in Costa Rica as part of numerous biosystyematic surveys initiated by Drs. Janzen and Holzenthal, more material of this genus was obtained. This has recently been forwarded to me for study, with rather surprising results: the number of species known from Costa Rica has increased to five of which two are new to science.

Chloronia mexicana Stitz, 1914, known previously from eastern Mexico south into central Guatemala, is recorded for the first time from Costa Rica, where it is quite common in the drier northwestern corner. *Chloronia gloriosoi* Penny & Flint, 1982, otherwise known only from the type series taken in the mountains of northern Panama, was found in the wet mountains of central Costa Rica. The new species, *C. absona,* is known from several pluvial, forest sites in the mountains of northern and central Costa Rica. The second new species, *C. osae,* is recorded from two wet forests sites, one in the lowlands of the Osa Peninsula, the other much higher in the mountains, both localities near the southern border of the country. *Chloronia mirifica* has the greatest known distribution of any of the Costa Rican species, being known from Mexico south into Ecuador, at least, and is the most frequently encountered species in wet, forest sites in mountainous and hilly country.

The following key to the Costa Rican species primarily utilizes characters of the male genitalia because coloration will only reliably separate *C. mexicana.*

Key to Costa Rican Species

1 Apical two-thirds of antenna infuscate, forewings with conspicuously darkened cross-veins, but with virtually no other dark marks apicad of the basal spots ..... *C. mexicana*

– Only apical third or less of antenna infuscate, forewings with both cross-veins blackened and with conspicuous dark marks in membrane 2

2 Male genitalia with ninth gonostyli divided into a distinct basolateral, thumb-like lobe and a large mesal lobe ..... *C. absona*

– Ninth gonostyli entire, a simple clavate lobe 3

3 Male genialia with ninth tergum lacking small rows of short, dark setae, tenth gonostyli broadly trianguloid ending in a sharp apicomesal point ..... *C. mirifica*

– Ninth tergum with two pairs of rows of short, dark setae; tenth gonostyli rounded, lobes about as long as broad 4

4 Male genitalia with ninth sternites roughly quadrate, posterior margin with an obtuse angle laterad ... *C. osae*

– Ninth sternites produced both basolaterally and posteromesally..... ..... *C. gloriosoi*

Chloronia gloriosoi Penny & Flint
Fig. 1

Chloronia gloriosoi Penny & Flint, 1982:11.

This species had been known previously only from Fortuna in northern Panama, a wet forested site at 1050 m elevation on the western slope of the Cordillera Central. A single male has been taken in the Cordillera Central in Costa Rica.

Material.—Costa Rica [San José Province], Fila Carrillo, Parque Nacional Braulio Carrillo, 18 May 1984, A. Chacón, 1 ♂ (INBIO).

Chloronia mexicana Stitz
Fig. 1

Chloronia mexicana Stitz, 1914:199.—Penny & Flint, 1982:13.

This is an easily distinguished species; the color of the antennae and the wings (see key) permit recognition of examples of both sexes. The male genitalia (Penny & Flint 1982, figs. 34–36) are very distinctive, albeit very close to those of *C. pallida* (Davis), which may be no more than a color variant. In 1982 we had examples from no further south than northwestern Guatemala; the discovery of the species in northern Costa Rica is thus a major range extension.

Material.—Costa Rica, Guanacaste Province, Hacienda Tempisquito (Pelón de la Altura), 1 km NE km 254, Rt. 1, 10.84°N, 85.56°W, 100 m, 18 Jul 1987, Holzenthal, Morse & Clausen, 2 ♂, 6 ♀ (NMNH & UMSP); same data, except, Jun 1989, C. de la Rosa, 2 ♂, 1 ♀ (EBM). Río Tempisquito, Estación Maritiza, W side Volcán Orosí, 18 km E Rt. 1, 10.958°N, 85.497°W, 550 m, 2 Jun 1989, C. de la Rosa, 1 ♀; same data, except, 9 Jun 1989, 1 ♀; same data, except 5 Jul 1989, 1 ♀; same data, except 6 Jul 1989, 1 ♀ (EBM); same data, except Jul 1989, GNP Biodiversity Survey, 2 ♀ (INBIO). Finca Jenny, 31 km N Liberia, 10°51′55″N, 85°34′27″W, 300 m, Sep 1988, GNP Biodiversity Survey, 3 ♀ (NMNH & INBIO). Santa Rosa National Park, 5–7 Jun 1980, Janzen & Hallwachs, 1 ♀ (INBIO); same data, except 14–16 Jun 1980, 1 ♂ (INBIO).

Alajuela Province, Río Pizote, ca. 5 km (air) S Brasilia, 10.972°N, 85.345°W, 390 m, 12 Mar 1986, Holzenthal & Fasth, 2 ♀ (UMSP). Río Pizote, ca. 5 km N Dos Ríos, 10.948°N, 85.291°W, 470 m, 9 Mar 1986, Holzenthal & Fasth, 1 ♀ (NMNH). Finca San Gabriel, 2 km SW Dos Ríos, 600 m, Jun 1989, GNP Biodiversity Survey, 1 ♀ (INBIO).

Heredia Province, Río Peje, Estación El Ceibo, Parque Nacional Braulio Carrillo, 10.327°N, 84.078°W, 480 m, 29–31 May 1990, Holzenthal, Blahnik & Muñoz, 1 ♀ (NMNH).

Chloronia mirifica Navás
Fig. 2

Chloronia mirifica Navás, 1925:195.—Penny & Flint, 1982:10.

The neotype of this species is from Costa Rica where it appears to be the most commonly encountered species. It is also known from Mexico, Guatemala, Colombia, Ecuador, and Peru (a record based on a female

Fig. 1. Distributions of *Chloronia absona, C. mexicana, C. osae* and *C. gloriosoi* in Costa Rica.

that needs a male for verification). The earlier Costa Rican records are from the provinces of Alajuela (Aguas Zarcas) and Cartago (Tuís, Peralta and Juan Viñas).

Material.—Costa Rica, Alajuela Province, tributary Río Bochinche, Cerro Campana, ca. 6 km (air) NW Dos Ríos, 10.945°N, 85.413°W, 640 m, 15–16 Mar 1986, Holzenthal & Fasth, 2 ♂, 1 ♀ (UMSP); same data, except 22–23 Jul 1987, Holzenthal, Morse & Clausen, 2 ♀ (UMSP). Río San Lorencito and tributaries, Reserva Forestal San Ramón, 10.216°N, 84.607°W, 980 m, 1–4 May 1990, Holzenthal & Blahnik, 1 ♂ (UMSP); same data, except 13–16 Jun 1988, C. M & O. S. Flint, Jr. & Holzenthal, 1 ♂, 2 ♀ (NMNH); same data, except 4 May 1984, A. Solis Blanco, 2 ♂ (INBIO); same, data except 24 May 1986, 1 ♀ (INBIO).

Guanacaste Province, Río Tempisquito, Estación Maritiza, W side Volcán Orosí, 18 km E Rt. 1, 10.958°N, 85.497°W, 550 m, 19–20 Jul 1987, Holzenthal, Morse & Clausen, 2 ♀ (UMSP); same data, except 17–18

Fig. 2. Distribution of *Chloronia mirifica* in Costa Rica.

Jun 1988, C. M & O. S. Flint, Jr. & Holzenthal, 1 ♂, 8 ♀ (NMNH); same data, except 30 May 1989, C. de la Rosa, 1 ♂; same data, except 2 Jun 1989, 2 ♂, 1 ♀; same data, except 6 Jun 1989, 2 ♂, 4 ♀; same data, except 10 Jun 1989, 1 ♀; same data, except 23 Jun 1989, 1 ♀; same data, except 25 Jun 1989, 1 ♂, 1 ♀; same data, except 26 Jun 1989, 1 ♂, 1 ♀; same data, except 4 Jul 1989, 4 ♂, 6 ♀; same data, except 5 Jul 1989, 4 ♂, 9 ♀; same data, except 6 Jul 1989, 7 ♂, 10 ♀; same data, except 11 Sep 1989, 2 ♀ (EBM); same data, except Jun 1988, Janzen & Hallwachs, 1 ♂, 8 ♀ (INBIO); same data, except GNP Biodiversity Survey, 3 ♂, 5 ♀ (INBIO); same data, except Jul 1989, 3 ♂, 15 ♀ (INBIO). Río Sapoá, water dam near Estación Cerro El Hacha, 14 Jul 1989, C. de la Rosa, 1 ♀ (EBM). Río Orosí, Estación Pitilla, 10.991°N, 85.428°W, 700 m, 19–20 Jun 1988, C. M & O. S. Flint, Jr. & Holzenthal, 1 ♀ (NMNH); same data, except 11 Mar [no year or collector], 1 ♂; same data, except May 1988, GNP Biodiversity Survey, 1 ♂,

(INBIO); same data, except Jul 1988, 2 ♂, 2 ♀ (INBIO); same data, except Sep 1988, 1 ♀ (INBIO); same data, except Oct 1988, 2 ♀ (INBIO); same data, except Nov 1988, 1 ♀ (INBIO); same data, except Mar 1989, 1 ♂ (INBIO); same data, except 21 Mar–21 Apr 1989, 1 ♂ (INBIO); same data, except May 1989, 3 ♂ (INBIO). Vicinity Estación Murcielago, 8 km SW Cuajiniquil, 100 m, Jun 1989, GNP Biodiversity Survey, 1 ♂, 1 ♀ (INBIO). Estación Cacao, SW side Volcán Cacao, 1000–1400 m, Sep 1989, R. Blanco & C. Chavez, 2 ♀ (INBIO).

Heredia Province, Estación El Ceibo, Parque Nacional Braulio Carrillo, 400–600 m, Sep 1989, R. Aguilar & M. Zumbado, 1 ♂, 2 ♀ (INBIO); same data, except Oct 1989, 2 ♀ (INBIO); same data, except Nov 1989, 1 ♀ (INBIO).

Limón Province, Quebrada Gonzalez, Parque Nacional Braulio Carrillo, 10.160°N, 83.939°W, 480 m, 12–14 May 1990, Holzenthal & Blahnik, 5 ♂, 5 ♀ (UMSP). Río Segundo [9°53′00″N, 83°13′20″W], afluente Río Banano, 500 m, 28 Apr 1985, A. Solis, 1 ♀ (INBIO).

Puntarenas Province, Estación Quebrada Bonita, Reserva Biológica Carara, 50 m, Nov 1989, R. Zuniga, 1 ♀ (INBIO); same, except Estación Bijagual, 500 m, 1 ♀ (INBIO); same, except Jan 1990, 1 ♀ (INBIO). Finca Cafrosa, Estación Las Mellizas, Parque Nacional La Amistad, 1300 m, 20 Aug–4 Sep 1989, M. Ramirez & G. Mora, 1 ♂, 1 ♀ (INBIO).

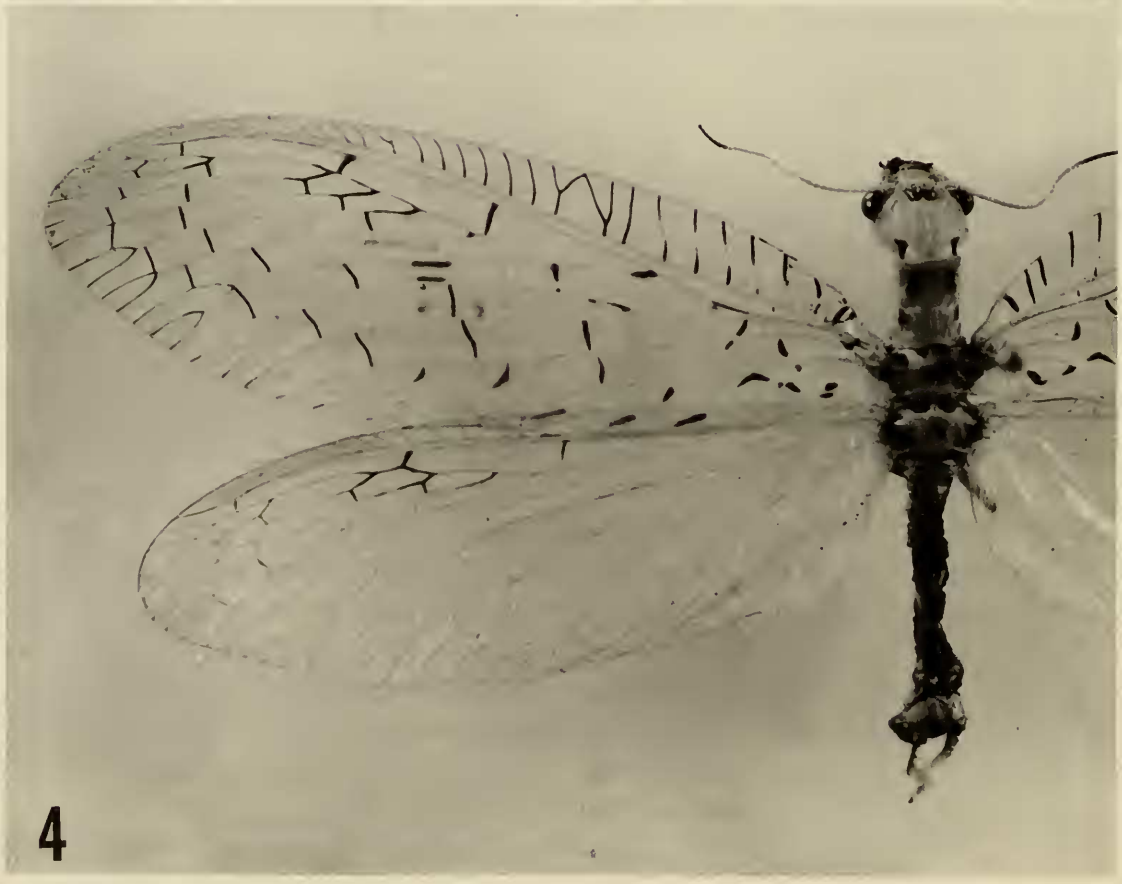
San José Province, La Montura, Parque Nacional Braulio Carrillo, 1100 m, 20 Mar 1983, R. L. Hestelberg, 1 ♂, 1 ♀ (INBIO).

Chloronia osae, new species
Figs. 1, 3, 5–7

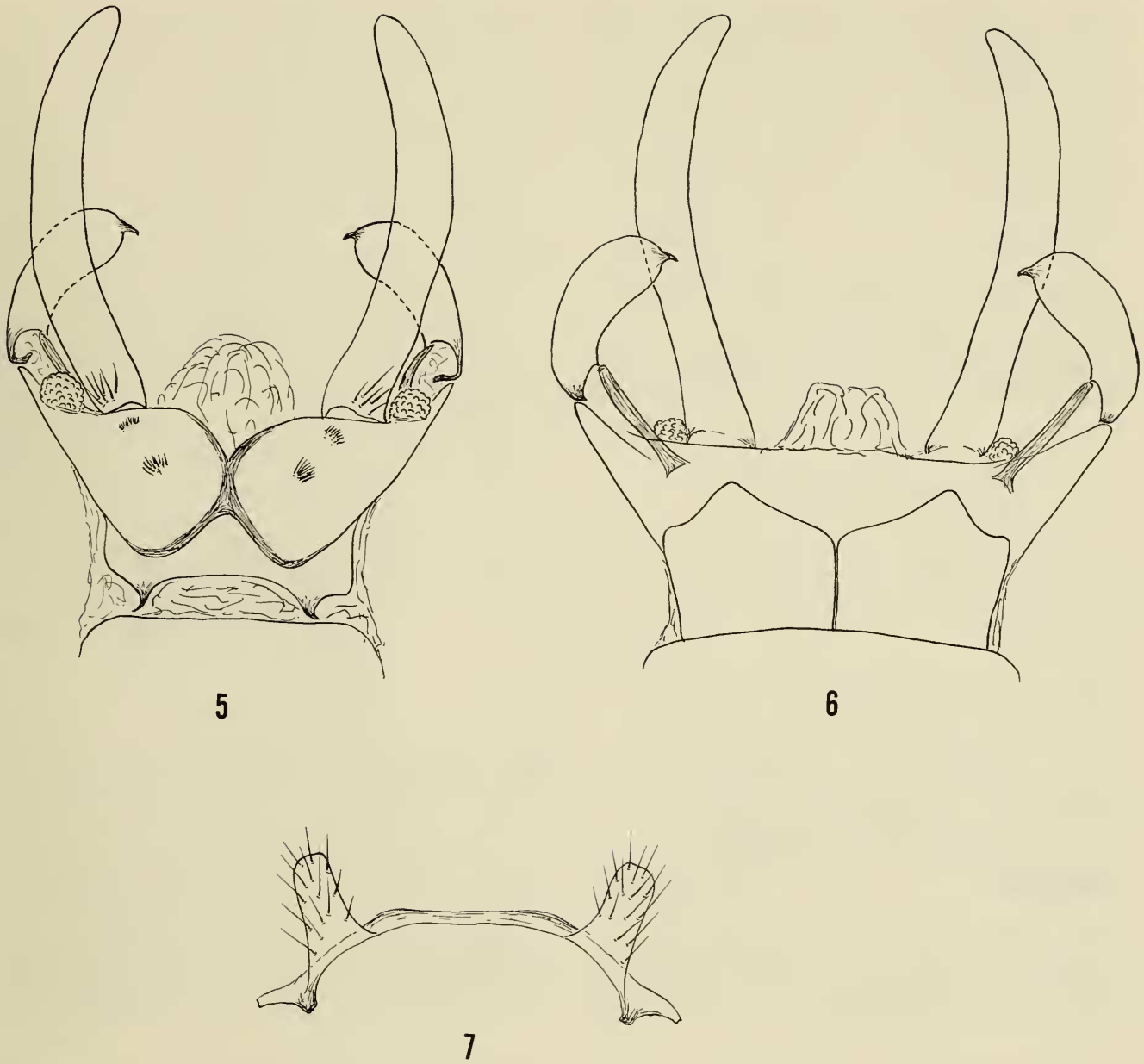
This species appears to be quite closely related to *C. antilliensis* Flint, known for certainty only from the island of Dominica in the Lesser Antilles. It differs quite strongly from *C. antilliensis* by having more strongly spotted forewings, especially near their bases. The male genitalia of the two species are very similar. The most distinctive differences being in the possession of three pairs of tufts of spinous setae dorsally in *C. osae* (two pairs on the ninth tergites and one basally on the tenth tergite), but only one pair in *C. antilliensis* (on the ninth tergite). The tenth segment gonostyli are a bit longer and the gonocoxites are a bit broader in *C. osae* than in *C. antilliensis.* The ninth sternum in *C. osae* lacks any development of the lateral lobe, which is present, although rather small, in *C. antilliensis.*

Adult.—Length of forewing 31–32 mm. Color generally pale yellow with fuscous spots. Head pale yellow with fuscous ocellar triangle, compound eyes, distal half of mandibles, labial and maxillary palpi. Two fuscous spots at posterior margin of occiput. Antenna with basal 25 segments pale yellow; apical 8–10 segments fuscous. Pronotum pale yellow, the 2 anterior and 2 posterior spots fuscous; mesonotum with 2 anteromesal and 2 lateral fuscous spots. Forewing pale yellow with costal crossveins wholly or at ends and all crossveins fuscous, a band of conspicuous very dark spots basad, some marking in membrane in radial and medial cells, but marginal cells with dark spots much reduced. Hindwing wholly pale yellow except for 2nd *r* fuscous. Male genitalia: Ninth tergum with anterior margin with broad, U-shaped, excision mesally about third depth of tergum; each tergite with 2 patches of short, spinous setae. Ninth sternite quadrate, with small lobe on posterior margin. Tenth tergite long, parallel-sided, slightly curved, with small, basal patch of enlarged, spinous setae. Ninth gonostylus incurved, hardly inflated apicad, with sharp apical point. Tenth gonostylus rounded, about twice as long as broad, connected by bandlike gonocoxite.

Material.—Holotype, male: Costa Rica, Puntarenas Province, Osa Peninsula, 2.5 mi SW Rincón, 8°42′N, 83°29′W, 1–7 Mar 1967, OTS advanced zoology course. INBIO Type. Paratype: [Costa Rica, Puntare-



Figs. 3–4. Habitus: 3, *Chloronia osae*; 4, *C. absona*.



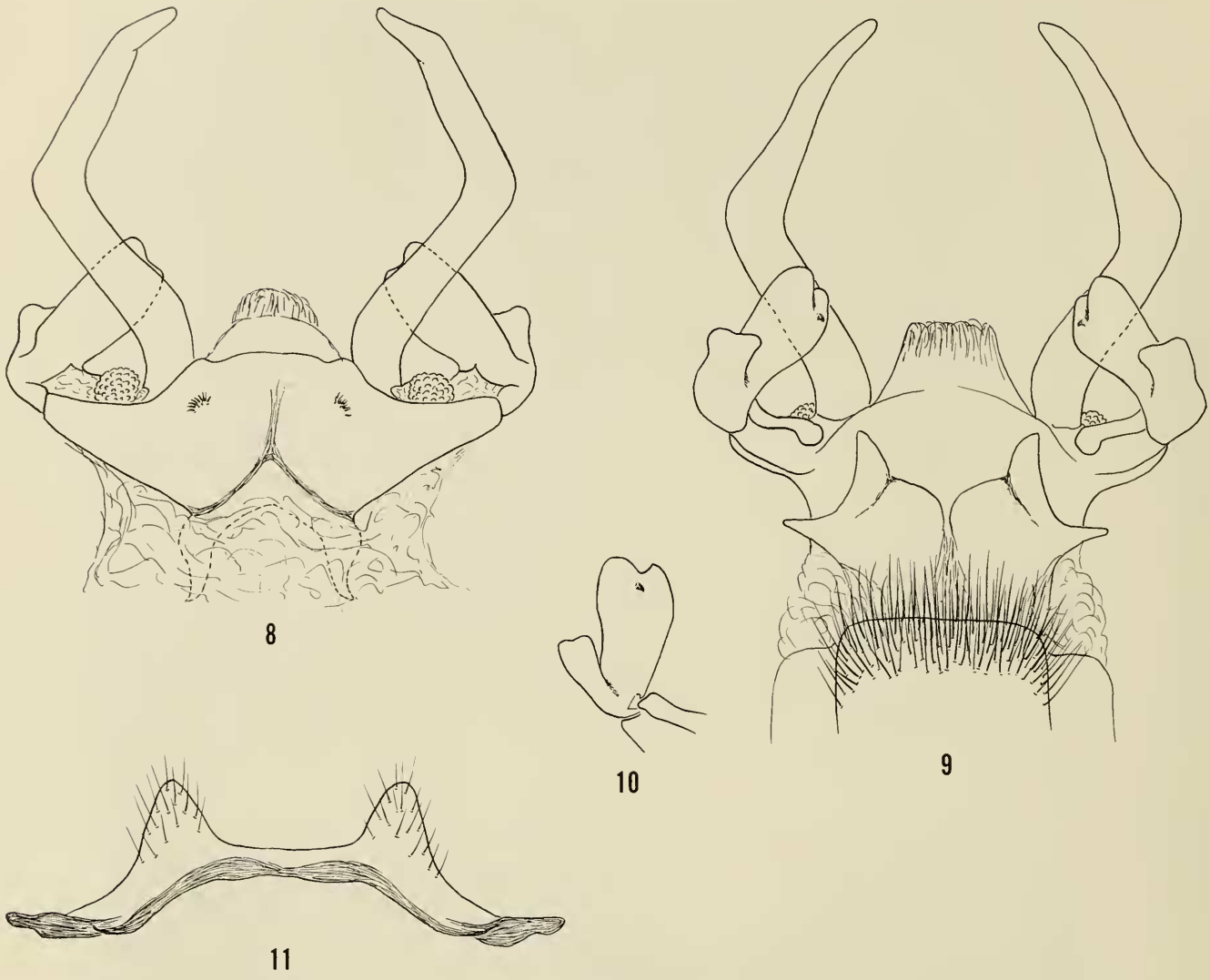
Figs. 5–7. Male genitalia of *Chloronia osae*: 5, dorsal; 6, ventral; 7, tenth gonocoxite and gonostyli.

nas Province], Las Cruces [Jardín Botánico Las Cruces, 6 km S San Vito on Rt. 16, ca. 1000 m], Sep 1986, L. D. Gómez, 1 ♂ (NMNH).

Chloronia absona, new species
Figs. 1, 4, 8–11

The male genitalia of this species are the most highly modified of any species yet known in the genus, making the relationships very difficult to determine. On the basis of the bilobate ninth sternites and rather broadly rounded tenth gonostyli it would seem to fit in with *C. mirifica* and *C. gloriosoi*. The long, angulate tenth tergites, produced, hairy eighth sternum, and above all the strange ninth gonostyli with their basolateral process and enlarged, shallowly bilobed apex displacing the small apical hook mesad are unique to this species.

Adult.—Length of forewing male 41–44 mm (ave. 42.75 mm, 4 examples), female 40–48 mm (ave. 43 mm, 6 examples). Color generally waxy yellow with fuscous spots. Head yellow with fuscous ocellar triangle, compound eyes, distal half of mandibles, labial and maxillary palpi. Two fuscous spots at posterior margin of occiput. Antenna with



Figs. 8–11. Male genitalia of *Chloronia absona*: 8, dorsal; 9, ventral; 10, ninth gonostylus, mesal view; 11, tenth gonocoxite and gonostyli.

35–40 segments; yellow basally, apical fourth infuscate. Pronotum yellow, the 2 anterior and 2 posterior spots fuscous; mesonotum with 2 anteromesal and 2 lateral fuscous spots. Forewing waxy yellow with costal crossveins wholly or at ends and all crossveins fuscous, basad with black spots reduced (limited to crossveins or vein junctions), some faint marking in membrane in radial and medial cells, marginal cells with dark spots elongate and very faint. Hindwing pale yellow except for 2nd *r* and veins and crossveins immediately posteriad fuscous. Male genitalia: Ninth tergum with anterior margin with V-shaped, excision mesally more than half depth of tergum; each tergite with single patch of short, spinous setae. Eight sternum with posteromesal margin slightly produced into quadrate lobe and bearing brush of long setae along posterior. Ninth sternite with distinct lateral and posterior projections. Tenth tergite very long, angulate at midlength and tapering slightly apicad. Ninth gonostylus incurved, inflated, produced and shallowly bilobed apicad, with large, almost rectangular, thumb-like lobe basolaterally, apical sclerotized point small and displaced mesad. Tenth gonostylus tapering but rounded apicad, slightly longer than broad, connected by bandlike gonocoxite which extends well laterad of gonostyli.

Material.—Holotype, male: Costa Rica, Alajuela Province, Río San Lorencito and

tributaries, Reserva Forestal San Ramón, 10.216°N, 84.607°W, 980 m, 1–4 May 1990, Holzenthal & Blahnik. NMNH Type. Paratypes: Same data, 1 ♂ (INBIO), 1 ♀ (NMNH); same, but 4 May 1987, A. Solis Blanco, 1 ♀ (INBIO). San José Province, Quebrada Sanguihuela, Parque Nacional Braulio Carrillo, 10.160°N, 83.963°W, 800 m, 27 Mar 1987, Holzenthal, Hamilton & Heyn, 1 ♂ (UMSP). Limón Province, Quebrada Gonzalez, Parque Nacional Braulio Carrillo, 10.160°N, 83.939°W, 480 m, 12–14 May 1990, Holzenthal & Blahnik, 1 ♂ (UMSP). Guanacaste Province, Pitilla, 9 km S Santa Cecilia, 700 m, 21 Mar–12 Apr 1989, P. Rios & C. Chaves, 1 ♂, 2 ♀ (NMNH); same, but May 1988, GNP Biodiversity Survey, 1 ♀ (INBIO); same, but Mar 1989, 1 ♀ (INBIO).

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Literature Cited

Navás, L. 1925. Insectos exoticos nuevos o poco conocidos, Segunda serie.—Memorias de la Real Academia de Ciencias y Artes de Barcelona, series 3, 19:181–200.

Penny, N. D., & O. S. Flint, Jr. 1982. A revision of the genus *Chloronia* (Neuroptera: Corydalidae).—Smithsonian Contributions to Zoology, 348:1–27.

Stitz, J. 1914. Sialiden der Sammlung des Berliner Museums.—Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, 1914(5): 191–205.

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